CLAIMS

1. A step-up/down DC-DC converter, comprising:

a voltage step-up/down part configured to generate and output a predetermined output voltage by stepping up or down an input voltage in accordance with a control signal input to the voltage step-up/down part; and

a control part configured to generate an error signal indicating an error between a voltage value obtained by dividing the output voltage and a predetermined reference voltage, compare the error signal and first and second triangle wave signals, and cause the voltage step-up/down part to perform a step-up or step-down operation based on a result of the comparison,

wherein the control part includes:

a first triangle wave generator circuit configured to generate the first triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-down operation; and

a second triangle wave generator circuit configured to generate the second triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-up operation,

the first triangle wave generator circuit

being configured to generate a clock signal synchronized with the generated first triangle wave signal, and output the generated clock signal to the second triangle wave generator circuit,

the second triangle wave generator circuit being configured to generate the second triangle wave signal synchronized with the first triangle wave signal based on the input clock signal, and output the second triangle wave signal.

2. The step-up/down DC-DC converter as claimed in claim 1, wherein the control part further comprises:

a first voltage generator circuit configured to generate and output a first voltage Va for setting a lower limit voltage of the first triangle wave signal;

a second voltage generator circuit configured to generate and output a second voltage Vb for setting an upper limit voltage of the first triangle wave signal;

a third voltage generator circuit configured to generate and output a third voltage Vc for setting an upper limit voltage of the second triangle wave signal; and

a current generator circuit configured to generate and output a current setting a slope of voltage variation of each of the first and second triangle wave signals,

the first triangle wave generator circuit being configured to generate the first triangle wave signal from the

first and second voltages Va and Vb and the current output from the current generator circuit,

the second triangle wave generator circuit being configured to generate the second triangle wave signal from the third voltage Vc, the current output from the current generator circuit, and the clock signal output from the first triangle wave generator circuit.

3. The step-up/down DC-DC converter as claimed in claim 2, wherein the first, second, and third voltage generator circuits are configured to generate and output the corresponding first, second, and third voltages Va, Vb, and Vc so that the first, second, and third voltages Va, Vb, and Vc satisfy $Va < Vb < Vc$ and $(Vb - Va) > (Vc - Vb)$.

4. The step-up/down DC-DC converter as claimed in claim 2, wherein the second triangle wave generator circuit is configured to decrease a voltage of the second triangle wave signal when the voltage of the second triangle wave signal reaches the third voltage Vc, and increase the voltage of the second triangle wave signal in synchronization with the clock signal.

5. The step-up/down DC-DC converter as claimed in claim 2, wherein each of the first, second, and third voltage

generator circuits is configured to generate a corresponding one of the first, second, and third voltages Va, Vb, and Vc by dividing a predetermined voltage by resistors.

6. The step-up/down DC-DC converter as claimed in claim 1, wherein the first triangle wave generator circuit is configured to synchronize the clock signal with a lower limit voltage of the first triangle wave signal.

7. A step-up/down DC-DC converter, comprising:

a voltage step-up/down part configured to generate and output a predetermined output voltage by stepping up or down an input voltage in accordance with a control signal input to the voltage step-up/down part; and

a control part configured to generate an error signal indicating an error between a voltage value obtained by dividing the output voltage and a predetermined reference voltage, compare the error signal and first and second triangle wave signals, and cause the voltage step-up/down part to perform a step-up or step-down operation based on a result of the comparison,

wherein the control part includes:

a first triangle wave generator circuit configured to generate the first triangle wave signal compared with the error signal to determine whether to cause the

voltage step-up/down part to perform the step-down operation; and

a second triangle wave generator circuit configured to generate the second triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-up operation,

the second triangle wave generator circuit being configured to generate a clock signal synchronized with the generated second triangle wave signal, and output the generated clock signal to the first triangle wave generator circuit,

the first triangle wave generator circuit being configured to generate the first triangle wave signal synchronized with the second triangle wave signal based on the input clock signal, and output the first triangle wave signal.

8. The step-up/down DC-DC converter as claimed in claim 7, wherein the control part further comprises:

a first voltage generator circuit configured to generate and output a first voltage Va for setting a lower limit voltage of the first triangle wave signal;

a second voltage generator circuit configured to generate and output a second voltage Vb for setting a lower limit voltage of the second triangle wave signal;

a third voltage generator circuit configured to

generate and output a third voltage Vc for setting an upper limit voltage of the second triangle wave signal; and

a current generator circuit configured to generate and output a current setting a slope of voltage variation of each of the first and second triangle wave signals,

the first triangle wave generator circuit being configured to generate the first triangle wave signal from the first voltage Va, the current output from the current generator circuit, and the clock signal output from the second triangle wave generator circuit,

the second triangle wave generator circuit being configured to generate the second triangle wave signal from the second and third voltages Vb and Vc and the current output from the current generator circuit.

9. The step-up/down DC-DC converter as claimed in claim 8, wherein the first, second, and third voltage generator circuits are configured to generate and output the corresponding first, second, and third voltages Va, Vb, and Vc so that the first, second, and third voltages Va, Vb, and Vc satisfy $Va < Vb < Vc$ and $(Vb - Va) < (Vc - Vb)$.

10. The step-up/down DC-DC converter as claimed in claim 8, wherein the first triangle wave generator circuit is configured to increase a voltage of the first triangle wave

signal when the voltage of the first triangle wave signal reaches the first voltage Va, and decrease the voltage of the first triangle wave signal in synchronization with the clock signal.

11. The step-up/down DC-DC converter as claimed in claim 8, wherein each of the first, second, and third voltage generator circuits is configured to generate a corresponding one of the first, second, and third voltages Va, Vb, and Vc by dividing a predetermined voltage by resistors.

12. The step-up/down DC-DC converter as claimed in claim 7, wherein the second triangle wave generator circuit is configured to synchronize the clock signal with an upper limit voltage of the second triangle wave signal.

13. A step-up/down DC-DC converter, comprising:

a voltage step-up/down part configured to generate and output a predetermined output voltage by stepping up or down an input voltage in accordance with a control signal input to the voltage step-up/down part; and

a control part configured to generate an error signal indicating an error between a voltage value obtained by dividing the output voltage and a predetermined reference voltage, compare the error signal and first and second

triangle wave signals, and cause the voltage step-up/down part to perform a step-up or step-down operation based on a result of the comparison,

wherein the control part includes:

first triangle wave generator means for generating the first triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-down operation; and

second triangle wave generator means for generating the second triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-up operation,

the first triangle wave generator means generating a clock signal synchronized with the generated first triangle wave signal, and outputting the generated clock signal to the second triangle wave generator means,

the second triangle wave generator means generating the second triangle wave signal synchronized with the first triangle wave signal based on the input clock signal, and outputting the second triangle wave signal.

14. A step-up/down DC-DC converter, comprising:

a voltage step-up/down part configured to generate and output a predetermined output voltage by stepping up or down an input voltage in accordance with a control signal

input to the voltage step-up/down part; and

a control part configured to generate an error signal indicating an error between a voltage value obtained by dividing the output voltage and a predetermined reference voltage, compare the error signal and first and second triangle wave signals, and cause the voltage step-up/down part to perform a step-up or step-down operation based on a result of the comparison,

wherein the control part includes:

first triangle wave generator means for generating the first triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-down operation; and

second triangle wave generator means for generating the second triangle wave signal compared with the error signal to determine whether to cause the voltage step-up/down part to perform the step-up operation,

the second triangle wave generator means generating a clock signal synchronized with the generated second triangle wave signal, and outputting the generated clock signal to the first triangle wave generator means,

the first triangle wave generator means generating the first triangle wave signal synchronized with the second triangle wave signal based on the input clock signal, and outputting the first triangle wave signal.